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Tri-Service Thermal Radiation Test Facility
Quartz High Density Lamp Bank and Computer Data Acquisition Operators Manual

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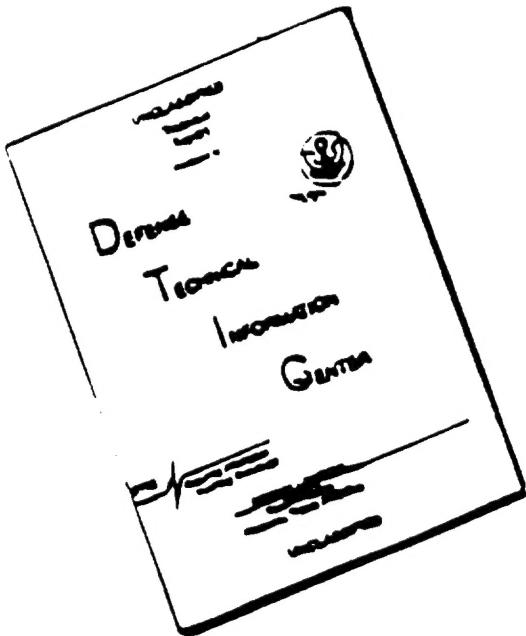
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13. ABSTRACT (Maximum 200 words)

Safe operational and servicing test procedures for the Quartz Lamp Bank and Windtunnel, and the Mobile Quartz Lamp Bank are described in this document. The manual guides test technicians, operating a Grid 486 microprocessor, in using proper safety and operational procedures in the operation, control and data acquisition of the Quartz Lamp and Windtunnel systems. A safety checklist to be followed prior to and during equipment utilization is provided. A description of instrumentation used in support of testing and procedures for servicing the test equipment is also provided.

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FIGURES

SECTION 1
INTRODUCTION

Control and Data Acquisition of the Quartz Lamp Bank, Windtunnel and Mobile Quartz Lamp Bank System is accomplished with a Grid 486 IBM-AT compatible computer, keyboard, color monitor, data acquisition board, and relay control board. The Grid 486 control board consists of 24 off-the-shelf solid state relays, and 24 LED displays to ease fault isolation of equipment.

The quartz lamp system is operated through Microsoft Windows. Acquired data can be graphed using Microsoft Excel. Storage media for the acquired data utilizes one of two hard drives installed in the computer. Data can also be transferred to either 3-1/2 inch or 5-1/14 inch diskettes.

SECTION 2
SAFETY

All procedures in the operation of test equipment within the Tri-Service Thermal Radiation Test Facility will be in accordance with the UDR-TR-94-70, "Tri-Service Thermal Radiation Test Facility Technical Support Plan (TSP) Instructions" which governs all activities within the TRTF.

2.1   SAFETY CHECKLIST.

The following procedures shall be followed to ensure the safety of all personnel and the safe operation of equipment during operation of the Quartz Lamp Bank (QLB) system.

Prior to system startup and operation, it shall be verified that all power to the system is in the "OFF" condition. Power switch locations for all system components are shown in Figure 2-1:

1. Ensure that the QLB Power Switch (circuit breaker) in the hallway of Bay 7 is in the "OFF" position.

2. Ensure that the Windtunnel Blower Power Switches on the west wall of Room 711 are in the "OFF" position.

3. Ensure that the amber indicator lamp on the wall mounted relay control panel in the Control Room 711C is not illuminated. If necessary, activate the fused toggle switch to the left of the panel to extinguish the lamp.

4. Push the RED Power Kill switch located on the Control Room wall to the "IN" position.

5. Ensure that the Grid 486 computer and monitor are turned "OFF".

6. Ensure that all LED displays on the relay control are in the "OFF" state.

2

**FLASH LAMP SIMULATOR CIRCUIT BREAKERS**

VORTEK DISCONNECT

WIND TUNNEL DISCONNECTS

RELAY BOARD POWER KILL

QUARTZ LAMP BANK DISCONNECT

HYDRAULIC TESTER DISCONNECT
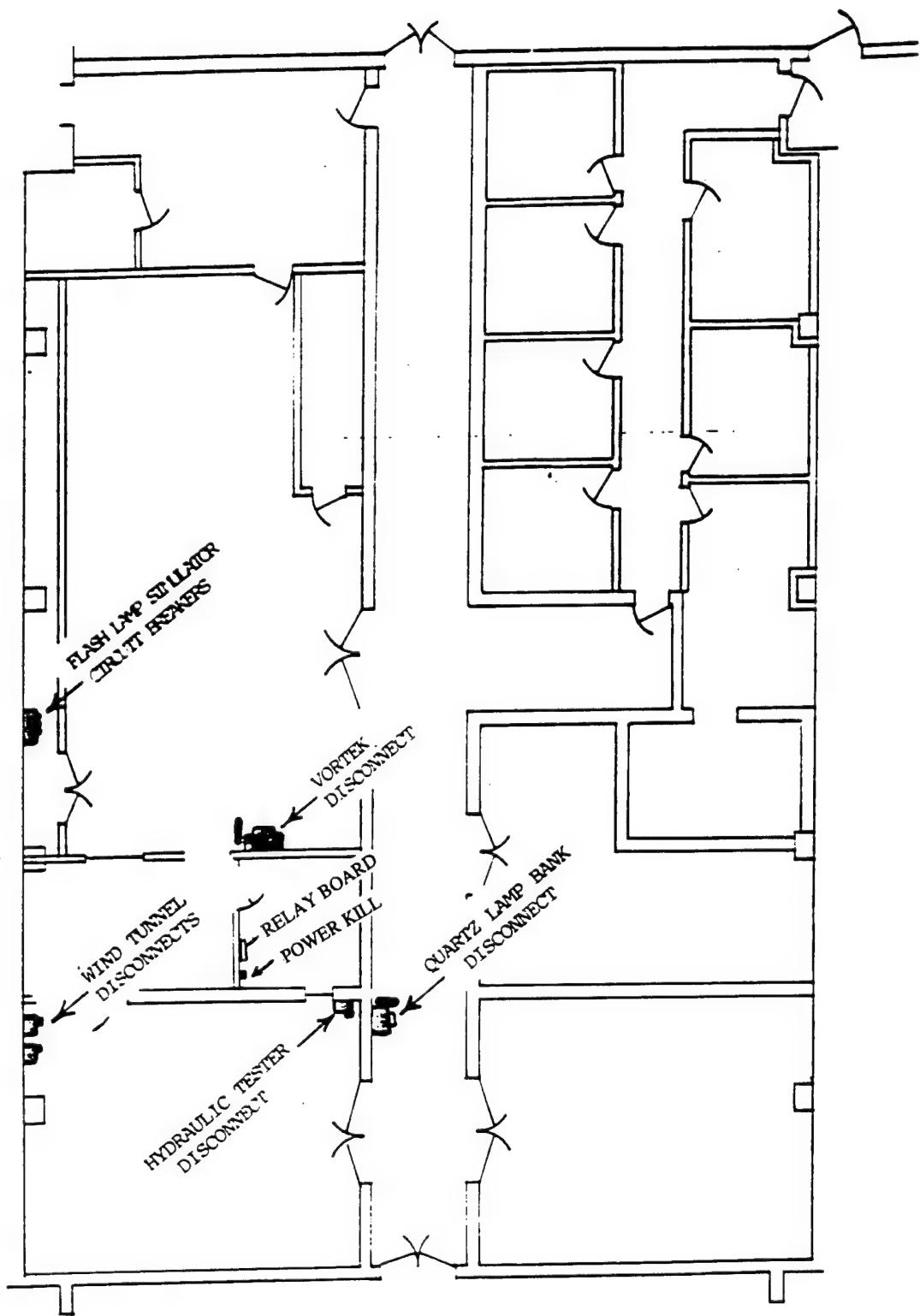
Figure 2-1. Quartz Lamp System Power Disconnect Locations.

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2.2 INSTRUMENTATION.

2.2.1 Calibration.

Select a calorimeter which encompasses the heat flux range specified in the test profile. Ensure that the calorimeter is connected to data acquisition, and that the cooling water circulator is connected to the calorimeter. Install the calorimeter in the sample holder.

2.2.2 Testing.

If the test sample contains thermocouple instrumentation, ensure that the thermocouples are connected to cold junction compensators. The compensators are battery operated, and battery voltage must have a minimum of 1.35 vdc.

The cold junction compensators must be turned ON. Install the test sample in the sample holder.

2.2.3 Computer Initiation.

At computer startup all outputs for control of the quartz lamp system will automatically reset.

2.2.3.1 Calibration:

1. Turn ON computer and monitor. Boot up will be verified by the prompt (c\:).

2. Type "cd\ad16" The prompt (c:\ad16) will appear.

3. Type "cal 16". A list of ranges will appear. Select range 4 by typing "4". Type "768" for board address. Type "16" for channel configuration. Press ENTER.

4. Press spacebar. CI016 Calibration Program will appear.

5. Type "1" and ENTER. Press spacebar. Select port configuration by typing "8". Press ENTER.

6. Type "M" for the menu. Select "4" to exit calibration. Prompt (c:\ad16) will appear.

7. Type "cd\". Prompt (c:\) will appear.

2.2.3.2 <u>Windows Program.</u> Type "WIN/S" and ENTER. The monitor will display Program Manager screen (Figure 2-2).

2.2.4   Prestart Checklist.

1. Check that the calorimeter or test sample is installed in the sample holder. If the calorimeter is installed, check lead plug-in to amplifier and cooling water circulation is turned ON. If an instrumented test sample is installed, check thermocouple connection to cold junction compensators, and power to compensators. Check compensator connections to amplifiers.

2. Activate QLB Power Disconnect circuit breaker in Bay 7 hallway (Figure 2-1).

3. Activate windtunnel blower switches in test room (Figure 2-1).

4. Activate toggle switch on the relay panel on data acquisition room wall (Figure 2-1). Amber light on panel will illuminate.

5. Pull the red Power Kill button, also located on the data acquisition room wall to the OUT position.

6. Clear the test room of all personnel.
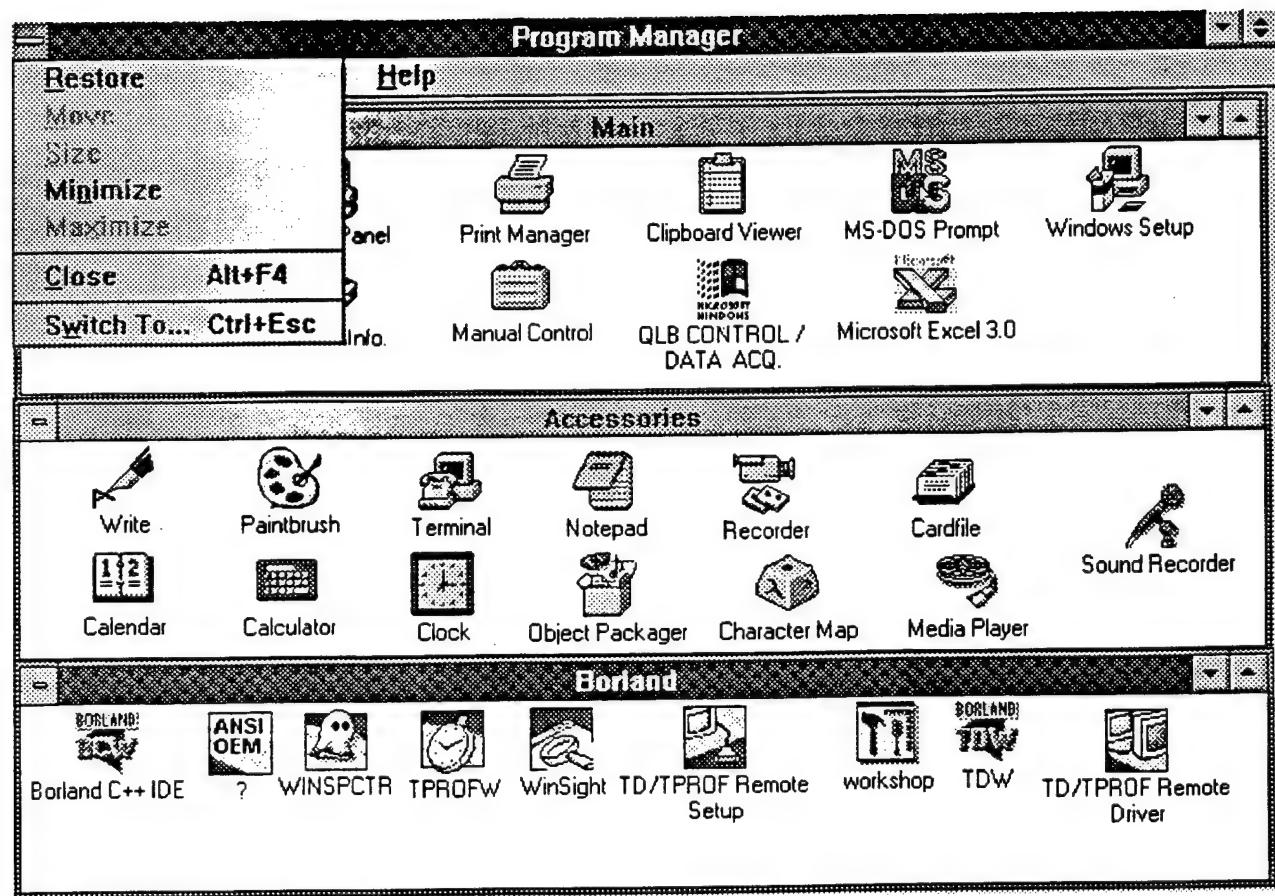
Figure 2-2.   Windows Program - Main Menu.

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SECTION 3
OPERATION

3.1   QLB CONTROL.

With the computer program in Windows (Figure 2-2), use the mouse to execute the following:

1. Position arrow cursor to QLB CONTROL/DATA ACQ. in MAIN menu (Figure 3-1) and execute double click. Figure 3-2 will appear.

2. Position cursor to File in upper left corner of screen and execute single click. Position cursor on NEW and execute single click. Figure 3-3 will appear.

3. Fill in Customer and Specimen Title. Position cursor on OK and execute single click. Figure 3-4 will appear.

    NOTE: Operating test profiles are generally accomplished using a sequence of timed events, e.g. Power to QLB, Windtunnel Blowers, Shutter Actuation, Bell Warning Alarm, and QLB Cooling Fan operation. Test parameters for each event sequence on each PROFILE event screen (Figure 3-4). Each event is displayed by positioning cursor on small arrows on right side of screen to advance or to retreat event displays and executing single click. A typical test profile of events is shown in the Appendix.

4. Enter Description (e.g. number and type of lamps, lamp wattage), Control Voltage (0 to 3.5 vdc), and A/D Interval (milliseconds).

    NOTE: Description - Distinguishes one test from another, e.g. number of lamps, wattage, reflector in use.

    Control Voltage - Zero to 3.5 vdc, varies tri-phaser power from 0 to 480 vac.

    A/D Interval - Data collection per millisecond (1000 data points maximum per channel).

   Save - Position cursor and single click saves file for future use or modification.
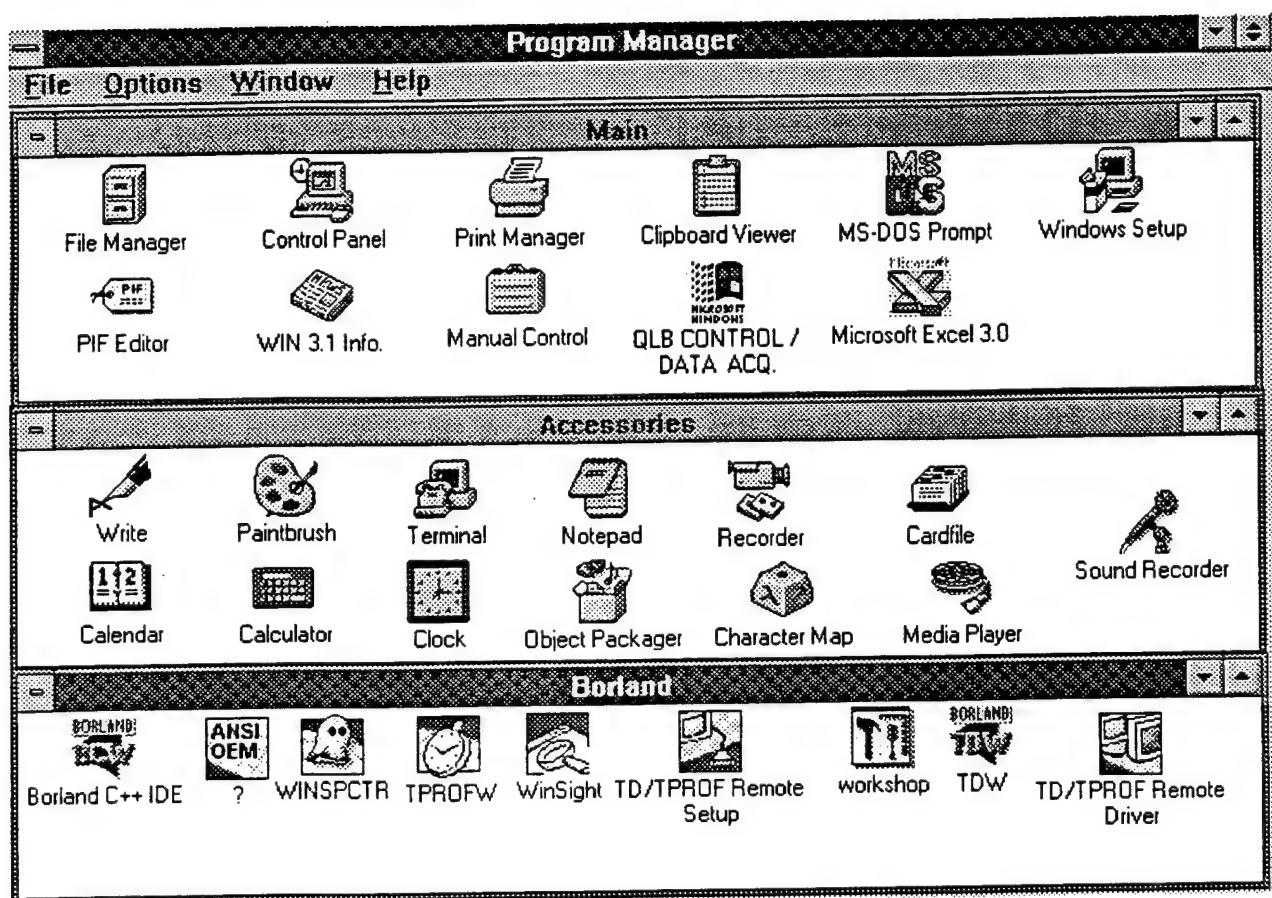
Figure 3-1.   Main Menu - QLB CONTROL/DATA ACQ.

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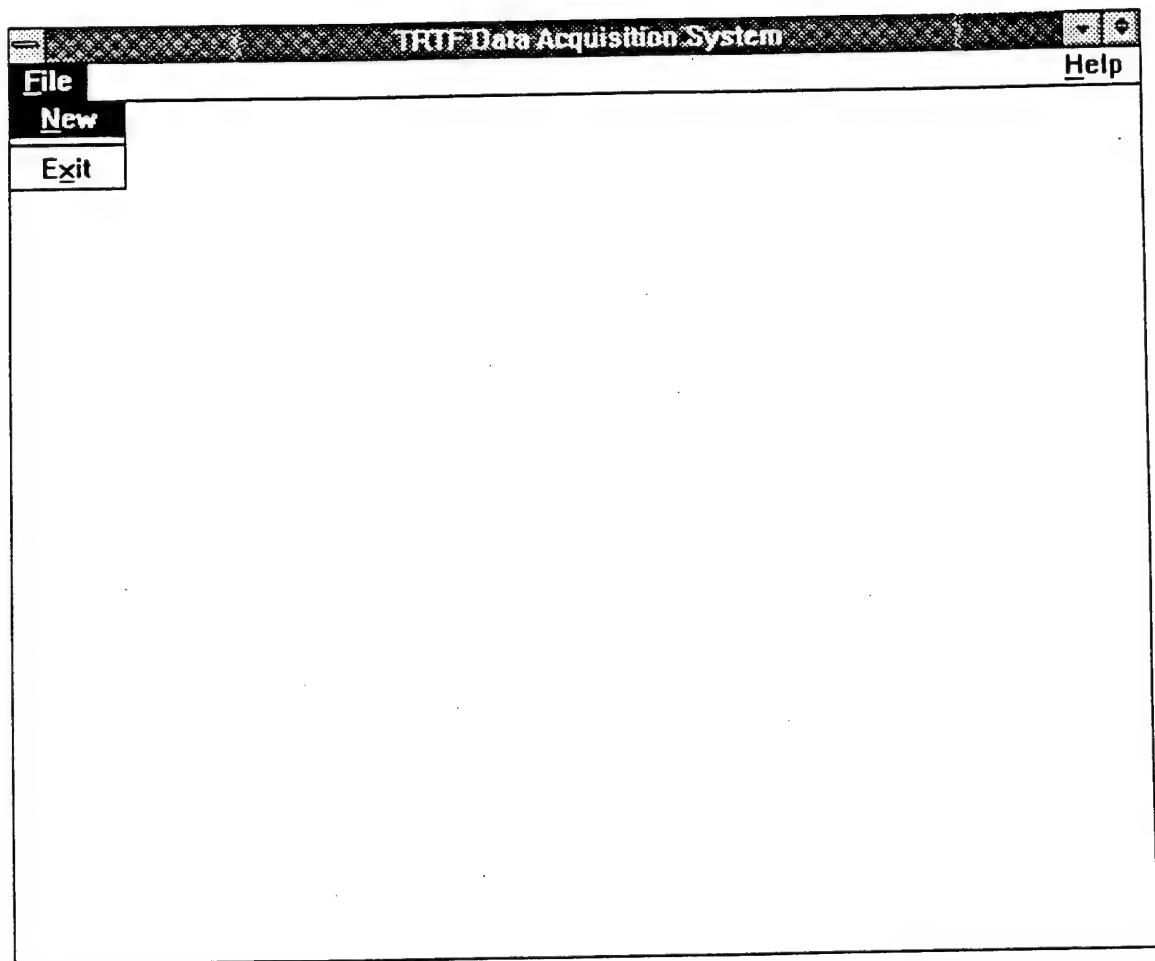
Figure 3-2.   File.
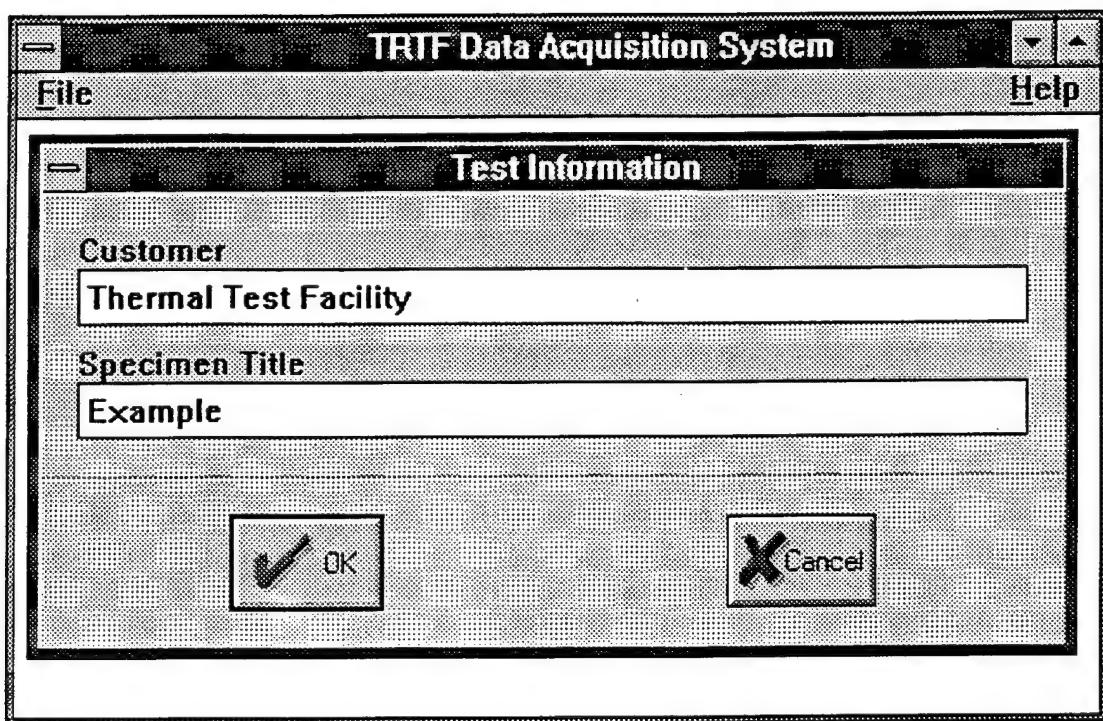
Figure 3-3.　Test Information.

Figure 3-4. Profile.

11
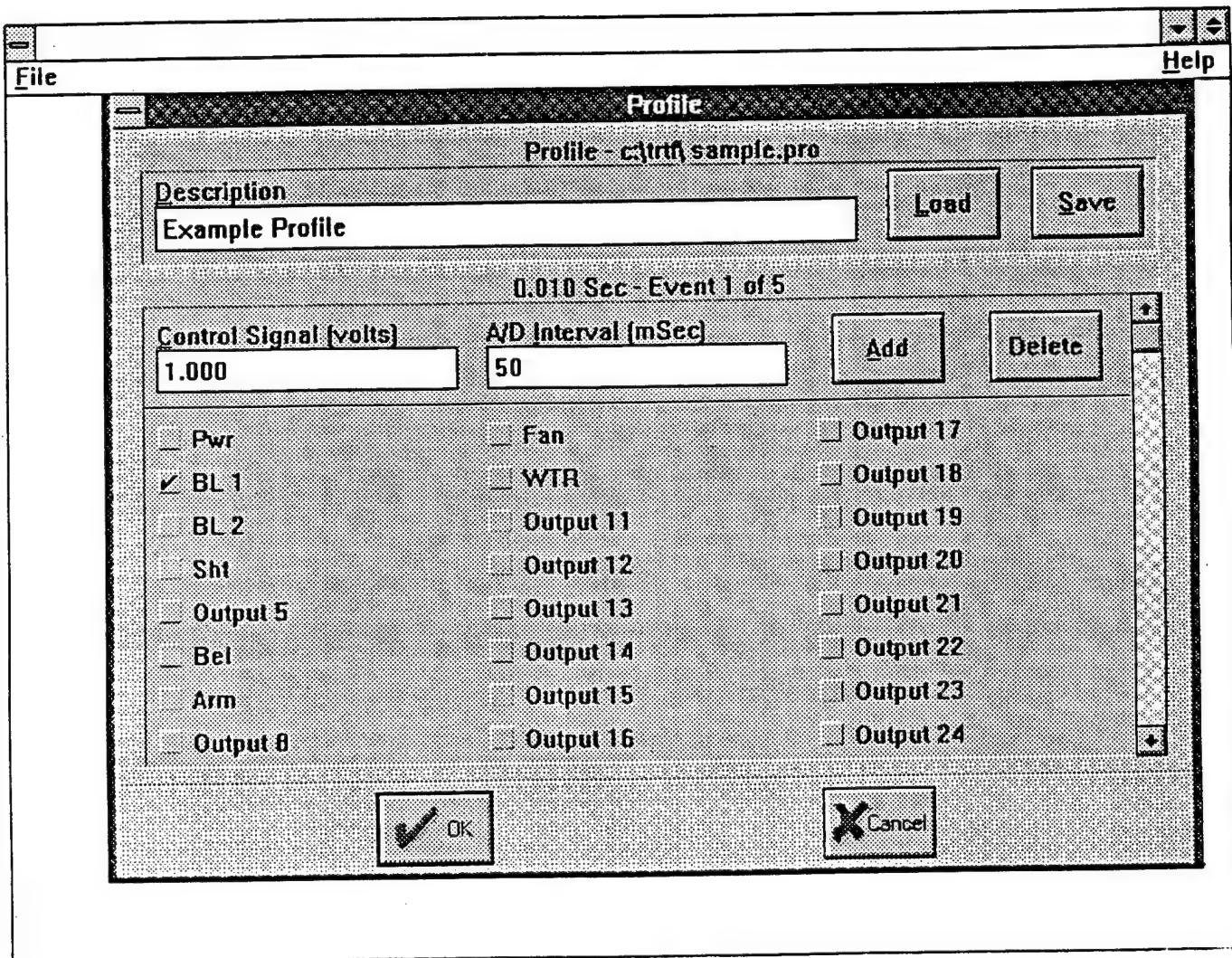
Load - Position cursor and execute single click to retrieve file that has been saved.

Add - Position cursor and execute single click to add to file.

Delete - Position cursor and execute single click to delete from file.

Pwr, BL1, BL2, Sht, etc. - Position cursor and execute single click to activate ( ), or deactivate ( ).

Enter information for each event screen to be used in test profile. Position cursor on OK and execute single click. Figure 3-5 will appear.

5. Enter sample description.

NOTE: Open - Position cursor and execute single click to change file.

Close - Position cursor and execute single click to save file.

Channel 1, 2, etc. - Enter description of instrumentation, e.g. thermocouple type, temperature in degrees F or in degrees C.

Position cursor on OK and execute single click. Figure 3-6 will appear.

6. If event and channel information has been correctly entered and verified, position cursor on Yes and execute single click. All test events will automatically start. At end of test sequence, Figure 3-7 will appear.

7. Enter file number followed by .xl and position cursor on OK and execute single click.

8. Position cursor on EXIT and execute single click. WINDOWS Program Manager (Figure 3-8) will appear.

3.2   DATA ACQUISITION.

3.2.1   Excel 3.0a.

1. Position cursor on EXCEL 3.0a of Program Manager and execute double click. Microsoft Excel (Figure 3-9) will appear.

2. Position cursor on FILE in upper left corner and execute single click. Figure 3-10 will appear.
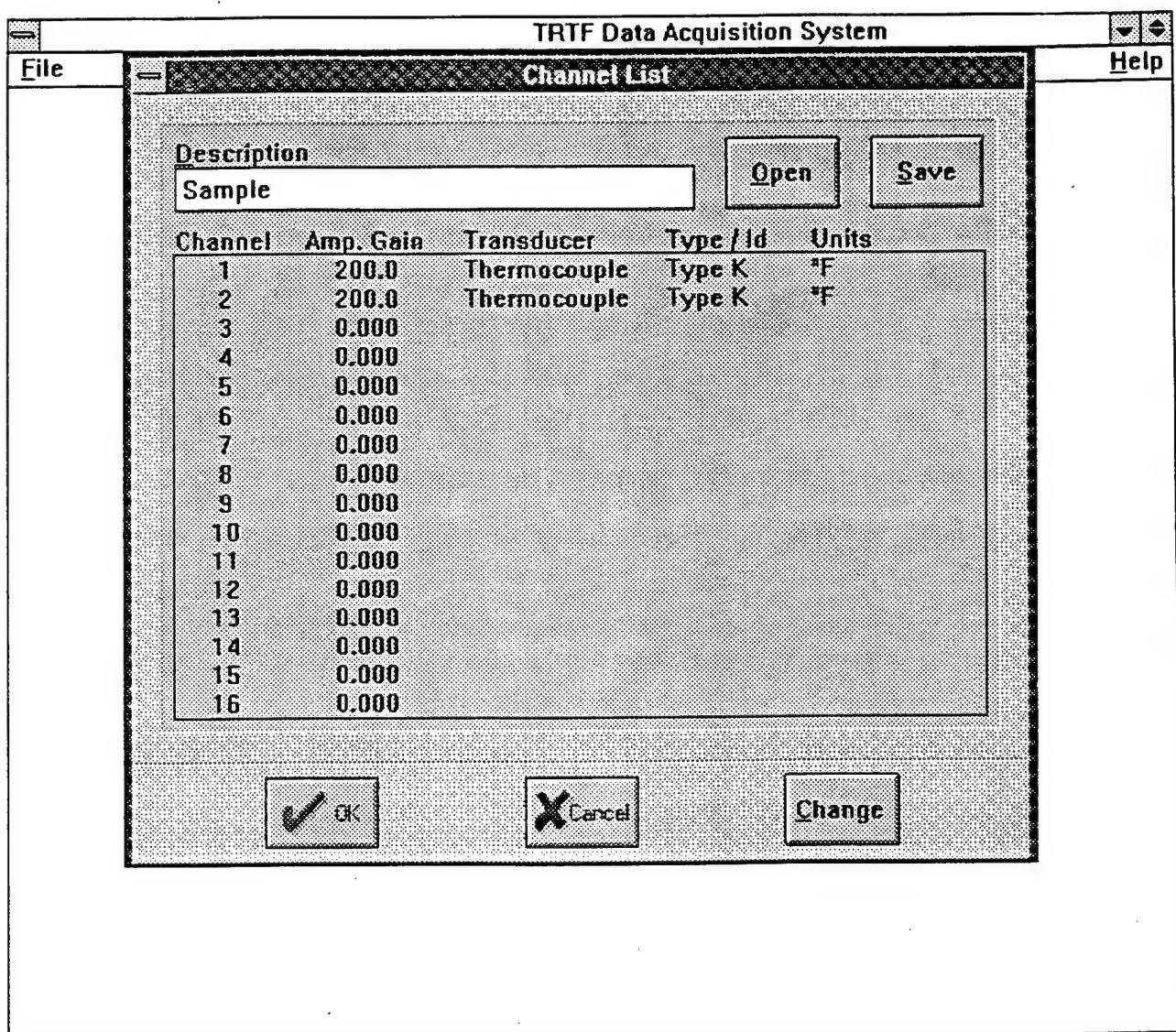
Figure 3-5. Channel List.
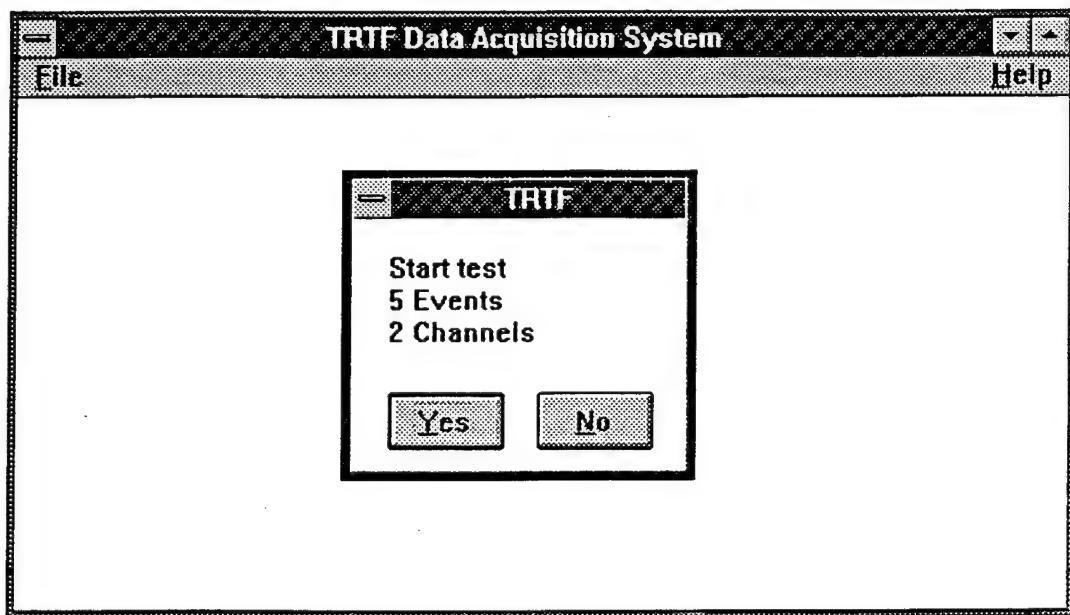
Figure 3-6. TRTF Operation.
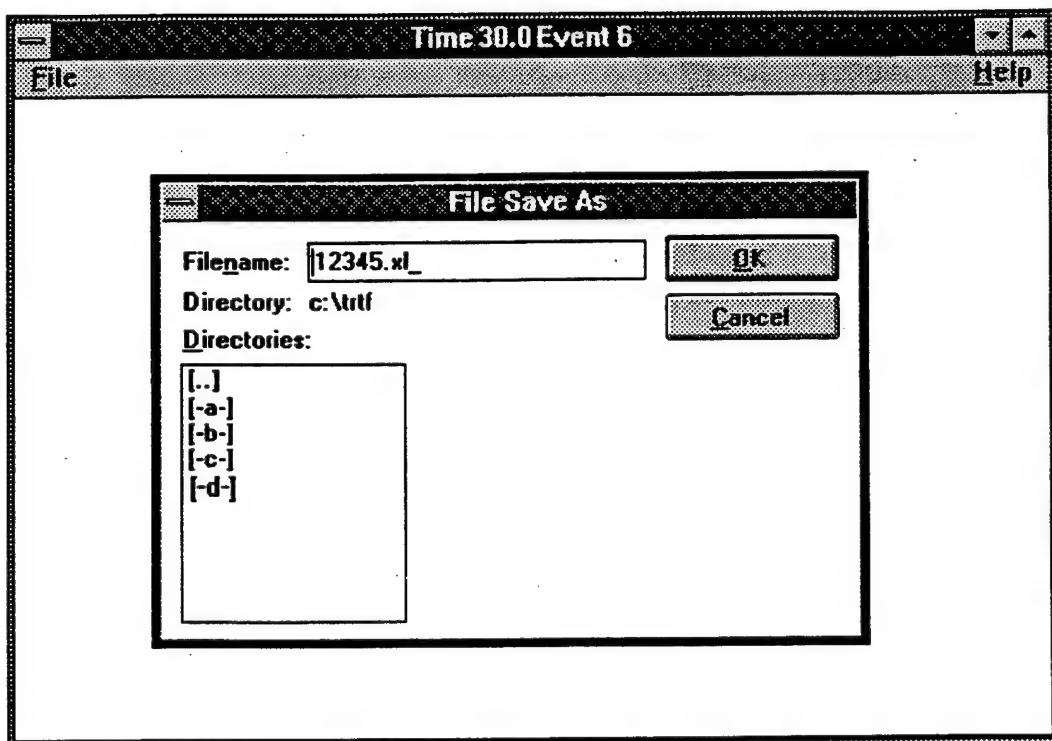
Figure 3-7.   File Save.

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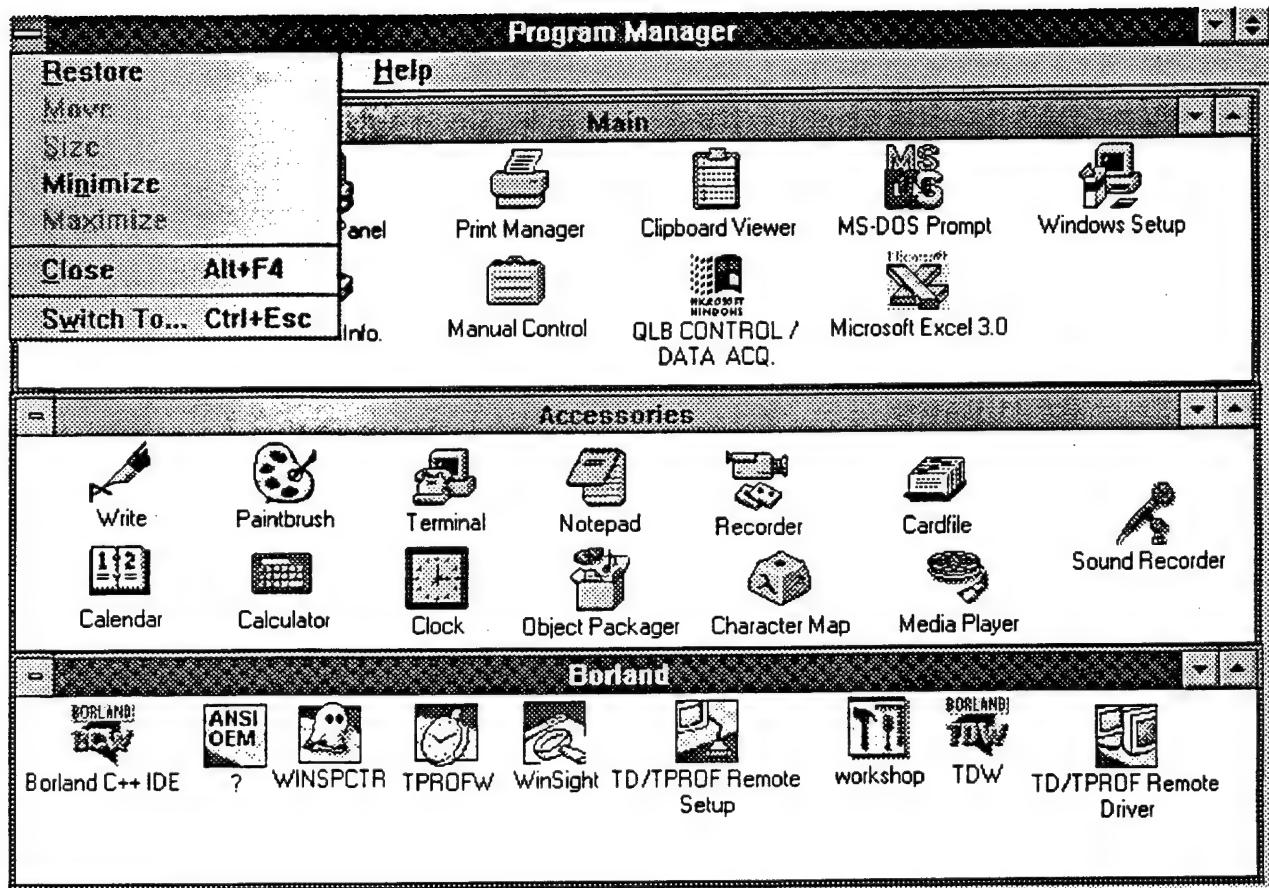
Figure 3-8.   Windows Program - Main Menu.

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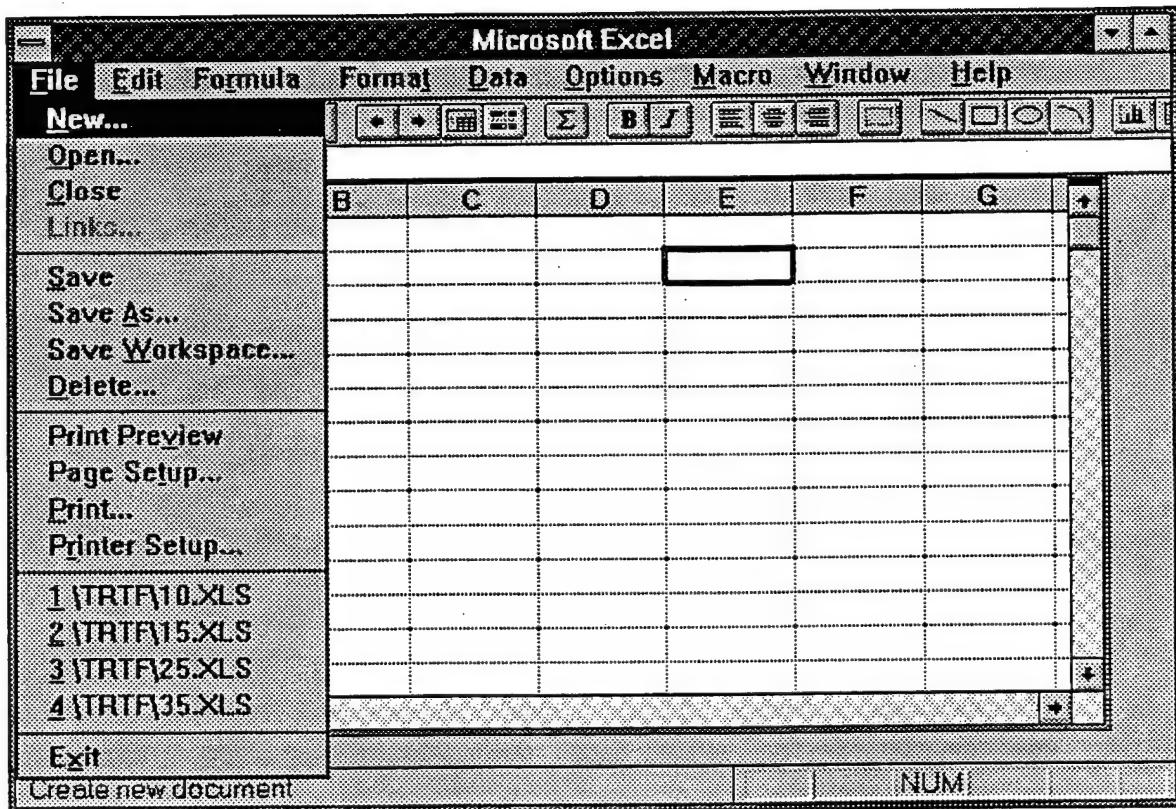
Figure 3-9.   Microsoft Excel.

17
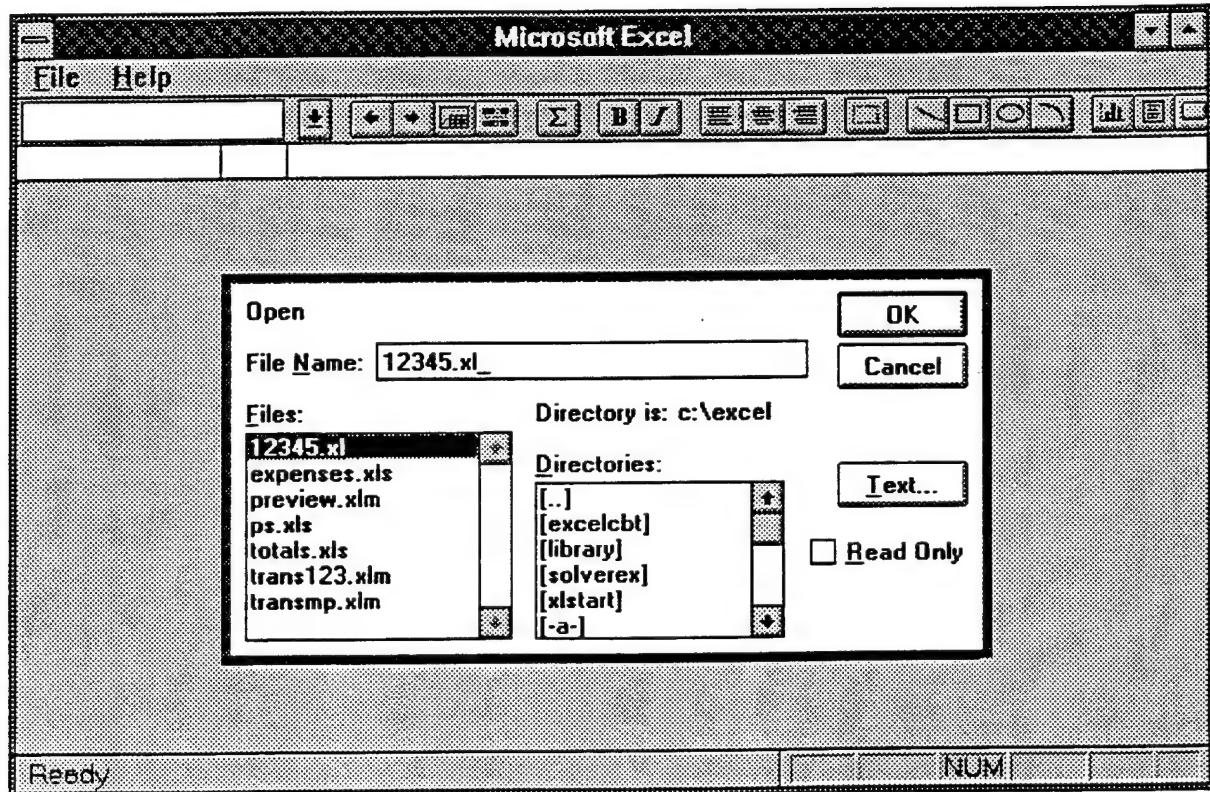
Figure 3-10. File.

3. Position cursor on OPEN and execute single click. A list of files will be displayed in Figure 3-10. Position cursor to file created for the test and execute a single click. Position cursor on OK and execute a single click. Figure 3-11 showing the selected data file will appear.

4. Execute and hold mouse click while moving mouse over entire area of data in Figure 3-11 to be plotted. When the entire area is shaded as shown in Figure 3-12, immediately release the click and position the cursor on the bar graph symbol in upper right corner of the screen.

5. Position cursor in lower left corner of screen (Figure 3-12). Execute and hold mouse click. Move cursor from lower left to upper right of screen to create data boundaries. Release the click. A small box will appear in the figure. Position cursor to select first column information (usually X-values for XY chart is selected) and execute single click. Position cursor to OK and execute single click. The plot will appear on the screen.

6. Position cursor on the plot area and execute a double click. Position cursor on GALLERY at top of screen and execute a single click. A variety of options for plotting will appear. Position cursor on selected option and follow Windows with cursor and single clicks.
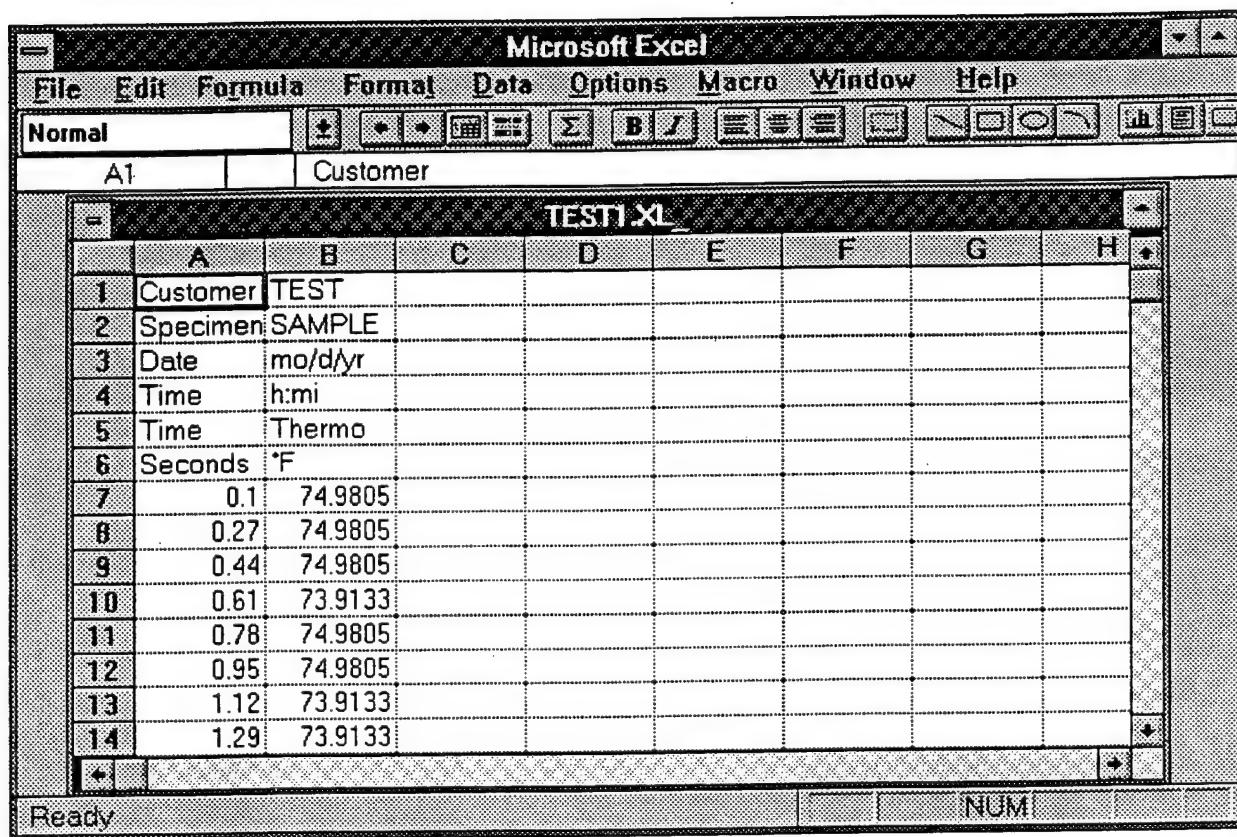
Figure 3-11.   File Information.
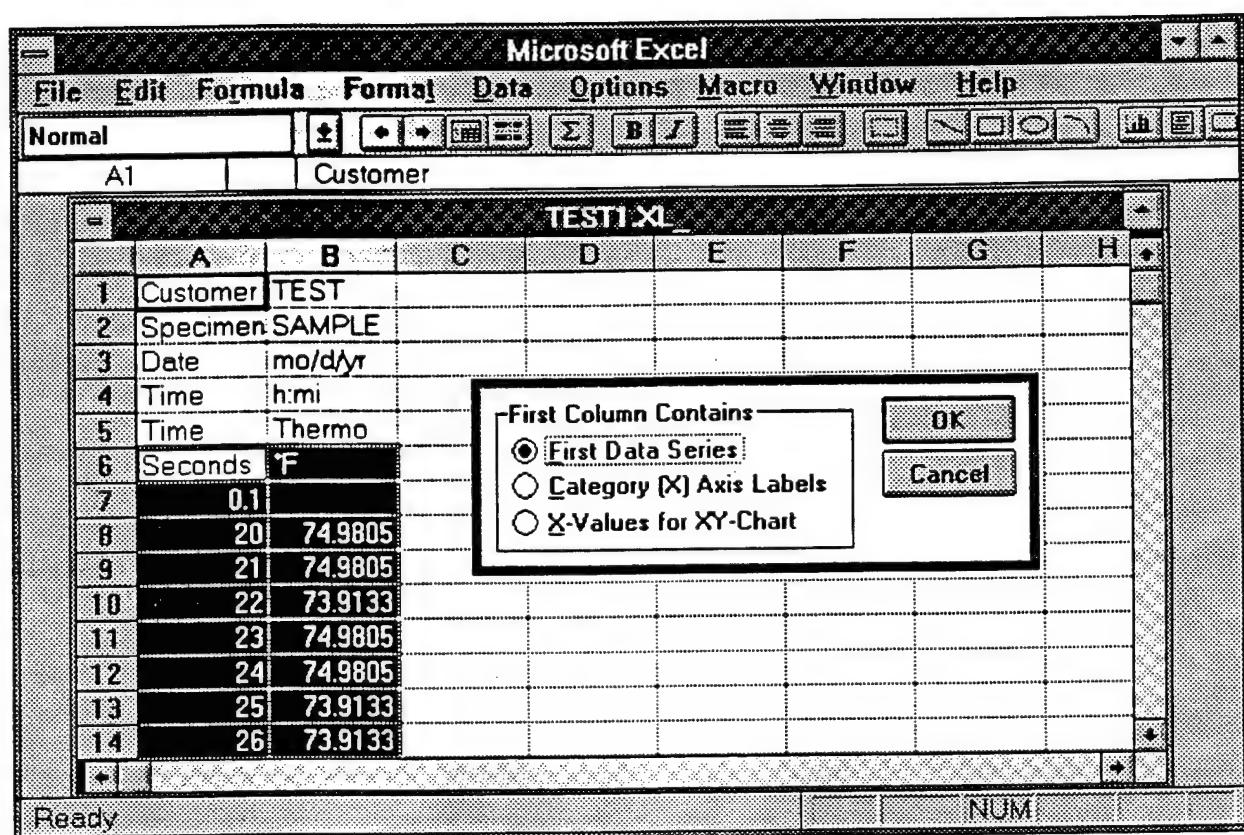
Figure 3-12. File Information (Shaded).

SECTION 4
SERVICING

The Quartz Halogen Infra-Red Heater Lamps (Quartz Lamps) used as the thermal source with the Large Test Section Wind Tunnel (LTS/WT) are to be handled only by qualified Tri-Service Thermal Test Facility personnel. Before removing or changing Quartz Lamps the Quartz Lamp Bank primary disconnect (Figure 3-6) must be pulled down to its OFF position. Voltage measurements across each of the three phases and to ground are to be taken to assure no voltage is present. Cotton gloves and safety eyeglasses, goggles or face shield are to be worn when handling Quartz Lamps and when replacing the Wind Tunnel quartz window. The air hose is to be disconnected from the air cylinder when servicing any part of the shutter mechanism. The Wind Tunnel primary disconnects (Figure 3-6) are to be pulled down to their OFF position whenever the Wind Tunnel must be serviced or opened for cleaning.

When servicing the hydraulic system of the Hydraulic Mechanical Tester, the main disconnect (Figure 3-6) must be pulled down to its OFF position. At no time should hands be placed between the cylinders of the test apparatus even when the hydraulic system has been disarmed since there are pressure accumulators in the system that could hold enough pressure to actuate the cylinder. Since the hydraulic hoses and controlling cables for the Hydraulic Tester may lay on the floor around the test machine, care should be taken not to trip or to slip on the hydraulic oil that could be present on the floor.

SECTION 5
HARDWARE

5.1   CONTROLS:

1. 24 2.5-10 vdc Computer controlled 60v 3.5 amp solid state relays
    14 3-32 vdc control 240v 25 amp solid state relays

2. Emergency power kill button

3. Magnetic contactor

4. 0-480 volts ac Tri-Phaser

5.2   DATA ACQUISITION:

1. 486 computer with a CIO16 DAS board

2. 16 University of Dayton signal conditioning amplifiers

3. 16 Omega cold junction compensators type K

APPENDIX

Profile

Profile - c:\trf\sample.pro

Description

Example Profile   Load   Save

0.001 Sec - Event 1 of 6

Control Signal (volts)   **A/D Interval (mSec)**   Add   Delete

1.000   0

☑ Pwr   ☑ Fan   ☐ Output 17
☑ BL 1   ☑ WTR   ☐ Output 18
☐ BL 2   ☐ Output 11   ☐ Output 19
☐ Sht   ☐ Output 12   ☐ Output 20
☐ Output 5   ☐ Output 13   ☐ Output 21
☐ Bel   ☐ Output 14   ☐ Output 22
☐ Arm   ☐ Output 15   ☐ Output 23
☐ Output 8   ☐ Output 16   ☐ Output 24

✓ OK   ✗ Cancel
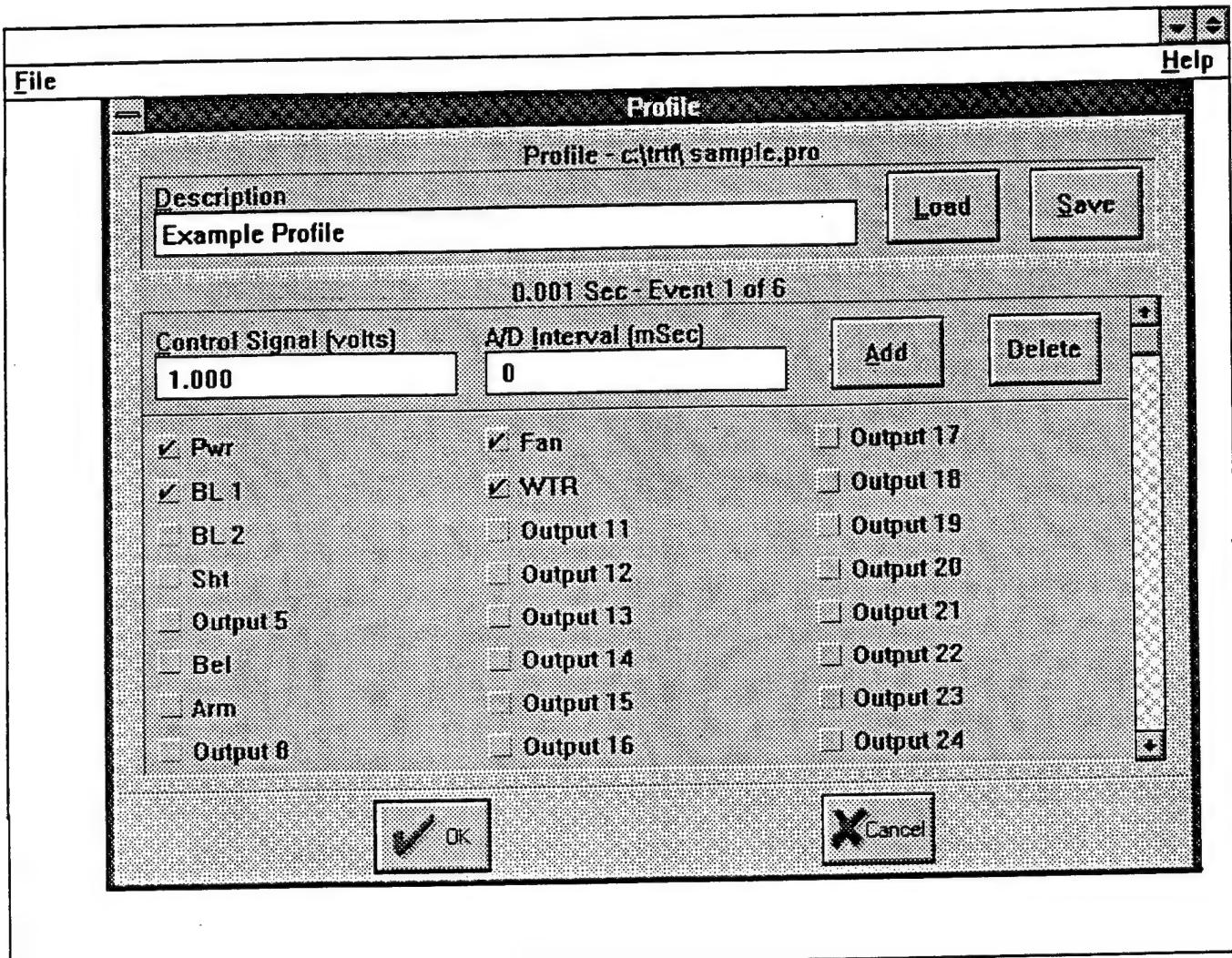
EVENT - 1

* Type in the **DESCRIPTION**.

1. Single click on **ADD**.

A. Enter the TIME (sec) of the first event.
    * Note generally something slightly greater than zero is used.
      Single click O.K.
    * Note the time entered in the black shaded area.

    1. Click in area titled **Control Signal (Volts)**.
        Type in the 0 to 3.5 vdc control voltage to control the lamps.

    2. Use the mouse to check ON or OFF equipment used for this
        point in time for *EVENT - 1*.
        * In this example the **PWR , BL1, FAN ,** and the **WTR** are checked
          ON.
        * If the **ARM** is checked at this point be aware that the control voltage
          entered will be sent to the lamps.
        * All options chosen at *EVENT - 1* will turn on at the time that was
          specified.

B. Goto *EVENT - 2* using **ADD**.

File   Help

Profile

Profile - c:\trf\sample.pro

Description

Example Profile

Load   Save

18.000 Sec - Event 2 of 6

Control Signal (volts)   **A/D Interval (mSec)**

1.000   0   Add   Delete

☑ Pwr	☑ Fan	☐ Output 17
☑ BL 1	☑ WTR	☐ Output 18
☐ BL 2	☐ Output 11	☐ Output 19
☐ Sht	☐ Output 12	☐ Output 20
☐ Output 5	☐ Output 13	☐ Output 21
☑ Bel	☐ Output 14	☐ Output 22
☑ Arm	☐ Output 15	☐ Output 23
☐ Output 8	☐ Output 16	☐ Output 24

OK   Cancel
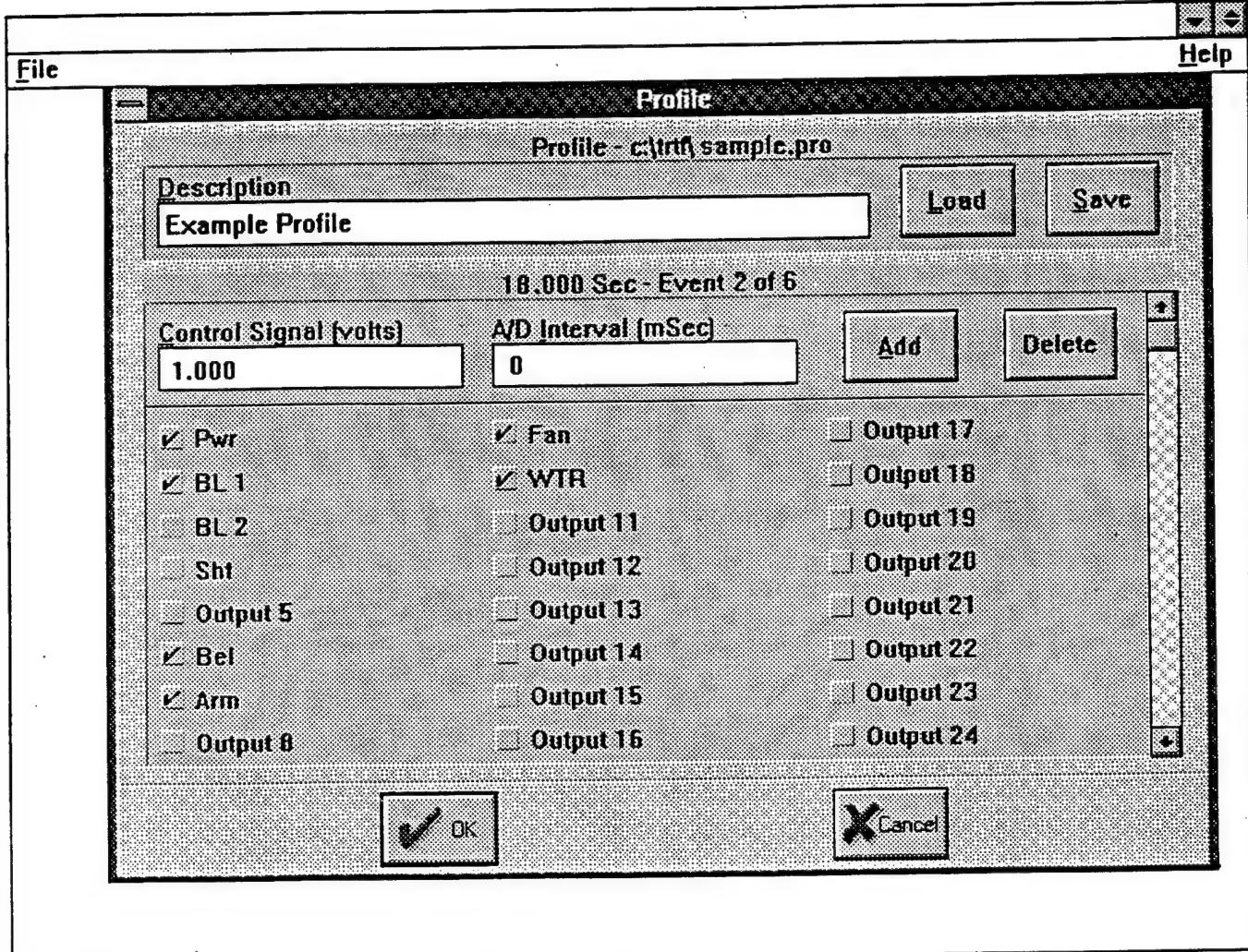
EVENT - 2
* The **Description** does not change.
2. Single click on **ADD**.

    A. Enter the TIME (sec) of the second event.
      * Note that generally a delay of about 18 sec. is used to alow the lamps
        to warm up. Single click O.K.
      * Note the time entered in the black shaded area.

      1. Click in area titled **Control Signal (Volts)**.
        Type in the 0 to 3.5 vdc control voltage to control the lamps.
        * The same voltage is generally used throughout the test.
      2. Use the mouse to check ON or OFF equipment used for this
        point in time for *EVENT - 2*.
      * In this example the **PWR , BL1, BEL , ARM , FAN ,** and the **WTR** are checked
      ON.
      * If the **ARM** is checked at this point be aware that the control voltage
      entered will be sent to the lamps.
      * Note the **SHT** is energized after a 2 second delay.
      * All options chosen at *EVENT - 2* will turn on at the time that was
      specified.

    B: Goto *EVENT - 3* using **ADD**.

A-3
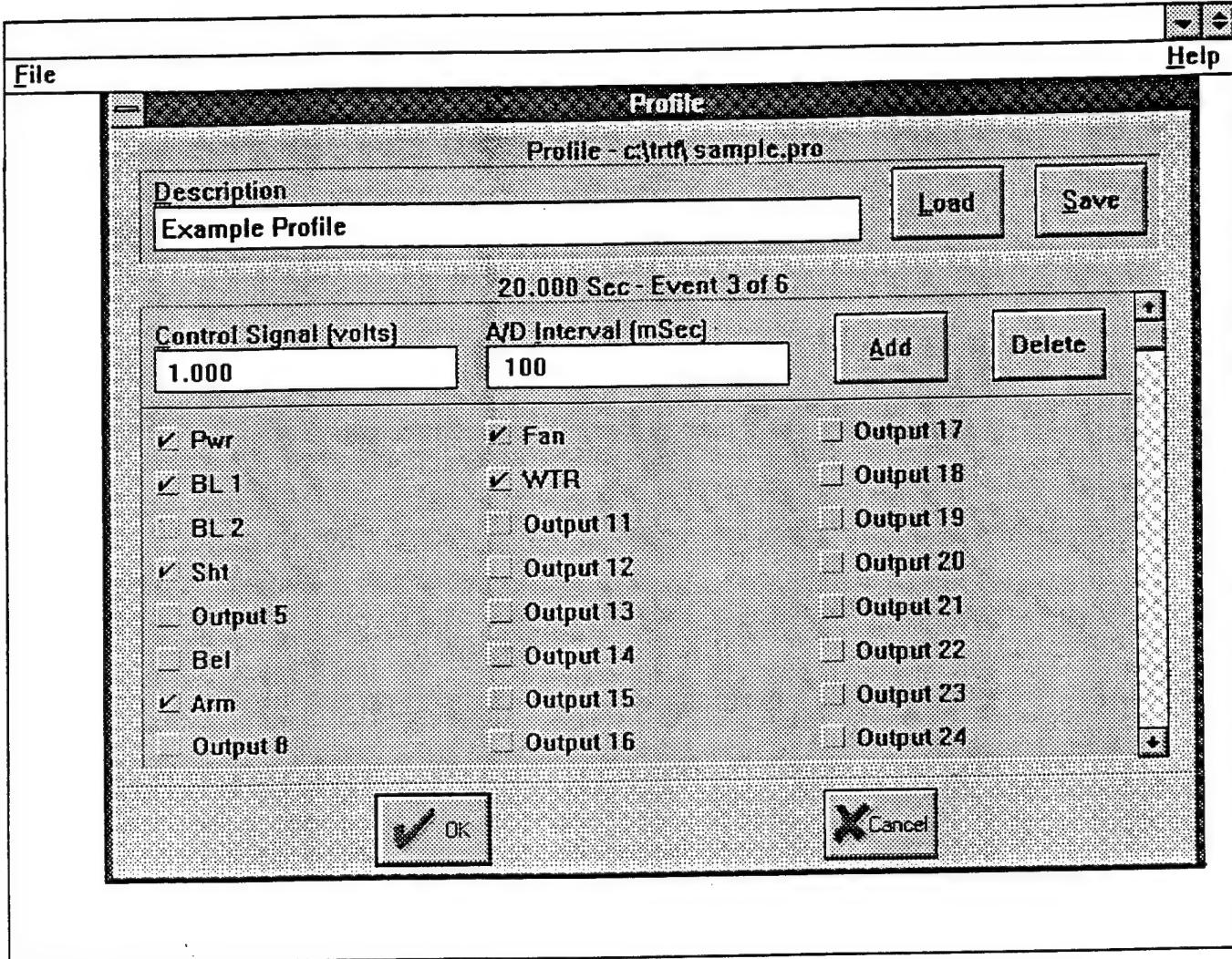
EVENT - 3
* The **Description** does not change.
3. Single click on **ADD**.

A. Enter the TIME (sec) of the third event.
  * Note that generally a delay of about 2 sec. is used to alow the warning
    Bell to sound. Single click O.K.
  * Note the time entered in the black shaded area.
  1. Click in area titled **Control Signal (Volts)**.
     Type in the 0 to 3.5 vdc control voltage to control the lamps.
     * The same voltage is generally used throughout the test.
  2. Click in area titled **A / D Interval (mSec)**.
     The length of the test has a direct bearing on this input.
     Enter 100 mSec.
     * Example, data collection starts at 20 sec. or event 3
     and finishes at the end of the test or 30 sec.
     This means data collection is 10 seconds long.
     Remember only 1000 data points per channel.
     10 sec. / 100ms or (interval) = 100 total data points.
  3. Use the mouse to check ON or OFF equipment used for this
     point in time for *EVENT - 3*.
     * In this example the **PWR, BL1, SHT, ARM, FAN**, and the **WTR** are checked
       ON.
     * If the **ARM** is checked at this point be aware that the control voltage
       entered will be sent to the lamps.
     * Note the **SHT** is energized after 2 seconds of lamp ON or
       a 2 second delay.
     * All options chosen at *EVENT - 3* will turn on at the time that was
       specified.
  B. Goto *EVENT - 4* using **ADD**.

A-4

Profile

Profile - c:\trf\sample.pro

Description

Example Profile

[Load] [Save]

25.000 Sec - Event 4 of 6

Control Signal (volts)   **A/D Interval (mSec)**

1.000   100   [Add]   [Delete]

☑ Pwr   ☑ Fan   ☐ Output 17
☑ BL 1   ☑ WTR   ☐ Output 18
☐ BL 2   ☐ Output 11   ☐ Output 19
☐ Sht   ☐ Output 12   ☐ Output 20
☐ Output 5   ☐ Output 13   ☐ Output 21
☐ Bel   ☐ Output 14   ☐ Output 22
☑ Arm   ☐ Output 15   ☐ Output 23
☐ Output 8   ☐ Output 16   ☐ Output 24

[✔ Ok]   [✘ Cancel]
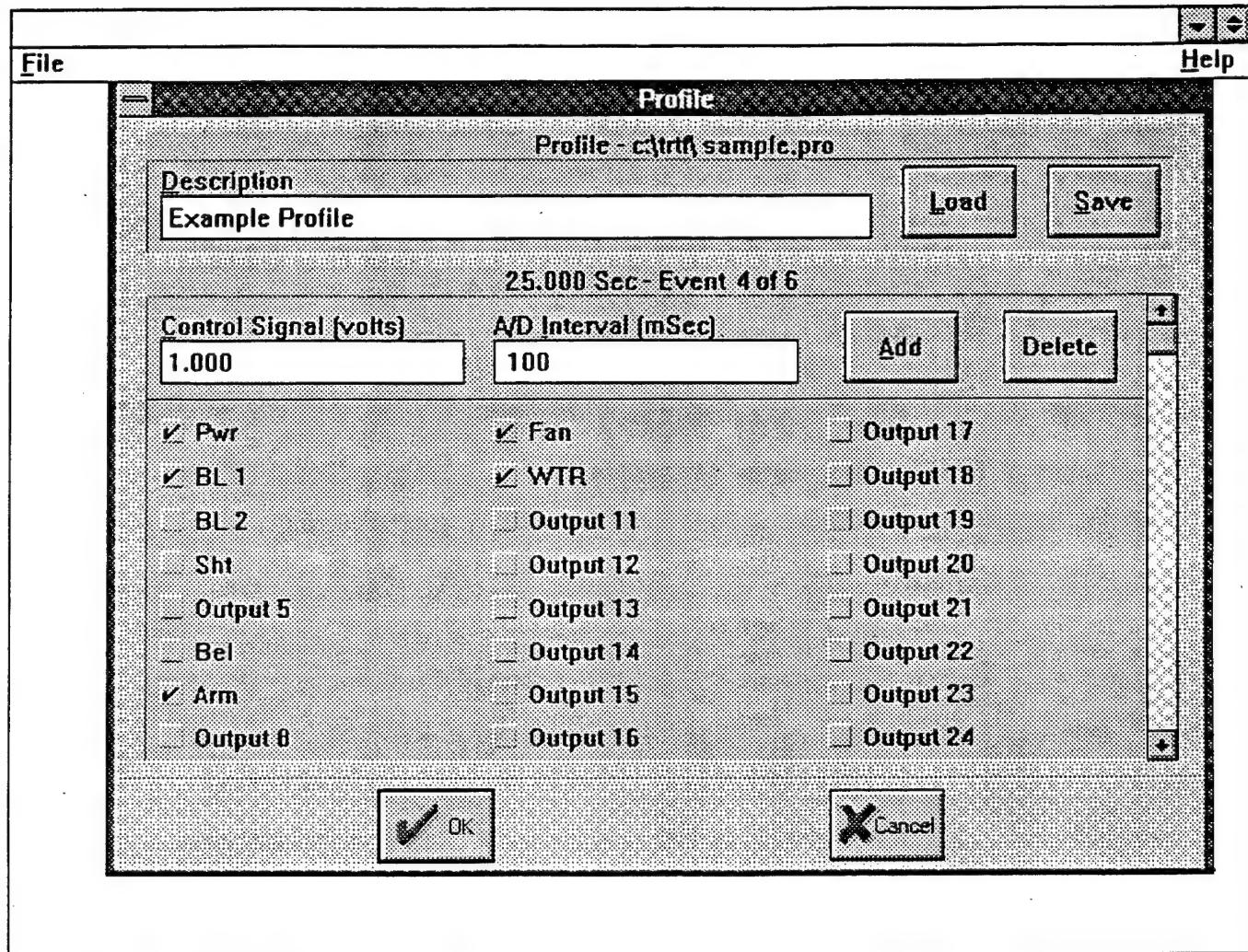
EVENT - 4
* The **Description** does not change.
4. Single click on **ADD**.

   A. Enter the TIME (sec) of the fourth event :
     Single click O.K.
     * Note the time entered in the black shaded area .
     1. Click in area titled **Control Signal (Volts)** .
       Type in the 0 to 3.5 vdc control voltage to control the lamps .
       * The same voltage is generally used throughout the test .
     2. Click in area titled **A / D Interval (mSec)** .
       The length of the test has a direct bearing on this input .
       Enter 100 mSec.
       * Example , data collection starts at 20 sec . or event 3
       and finishes at the end of the test or 30 sec.
       This means data collection is 10 seconds long .
       Remember only 1000 data points per channel .
       10 sec. / 100ms or (interval) = 100 total data points .
     3. Use the mouse to check ON or OFF equipment used for this
       point in time for *EVENT - 4* .
      * In this example the **PWR , BL1 , ARM , FAN ,** and the **WTR** are checked
      ON .
      * If the **ARM** is checked at this point be aware that the control voltage
      entered will be sent to the lamps .
      * Note the **SHT** is turned off after 5 seconds of sample exposure .
      * All options chosen at *EVENT - 4* will turn on at the time that was
      specified .
   B. Goto *EVENT - 5* using **ADD** .

Profile

Profile - c:\trtf\sample.pro

Description

Example Profile

| Load | Save |

26.000 Sec - Event 5 of 6

Control Signal [volts]

1.000

A/D Interval [mSec]

100

| Add | Delete |

✓ Pwr	✓ Fan	☐ Output 17
✓ BL 1	✓ WTR	☐ Output 18
☐ BL 2	☐ Output 11	☐ Output 19
☐ Sh1	☐ Output 12	☐ Output 20
☐ Output 5	☐ Output 13	☐ Output 21
☐ Bel	☐ Output 14	☐ Output 22
☐ Arm	☐ Output 15	☐ Output 23
☐ Output 8	☐ Output 16	☐ Output 24

| ✓ OK | ✗ Cancel |
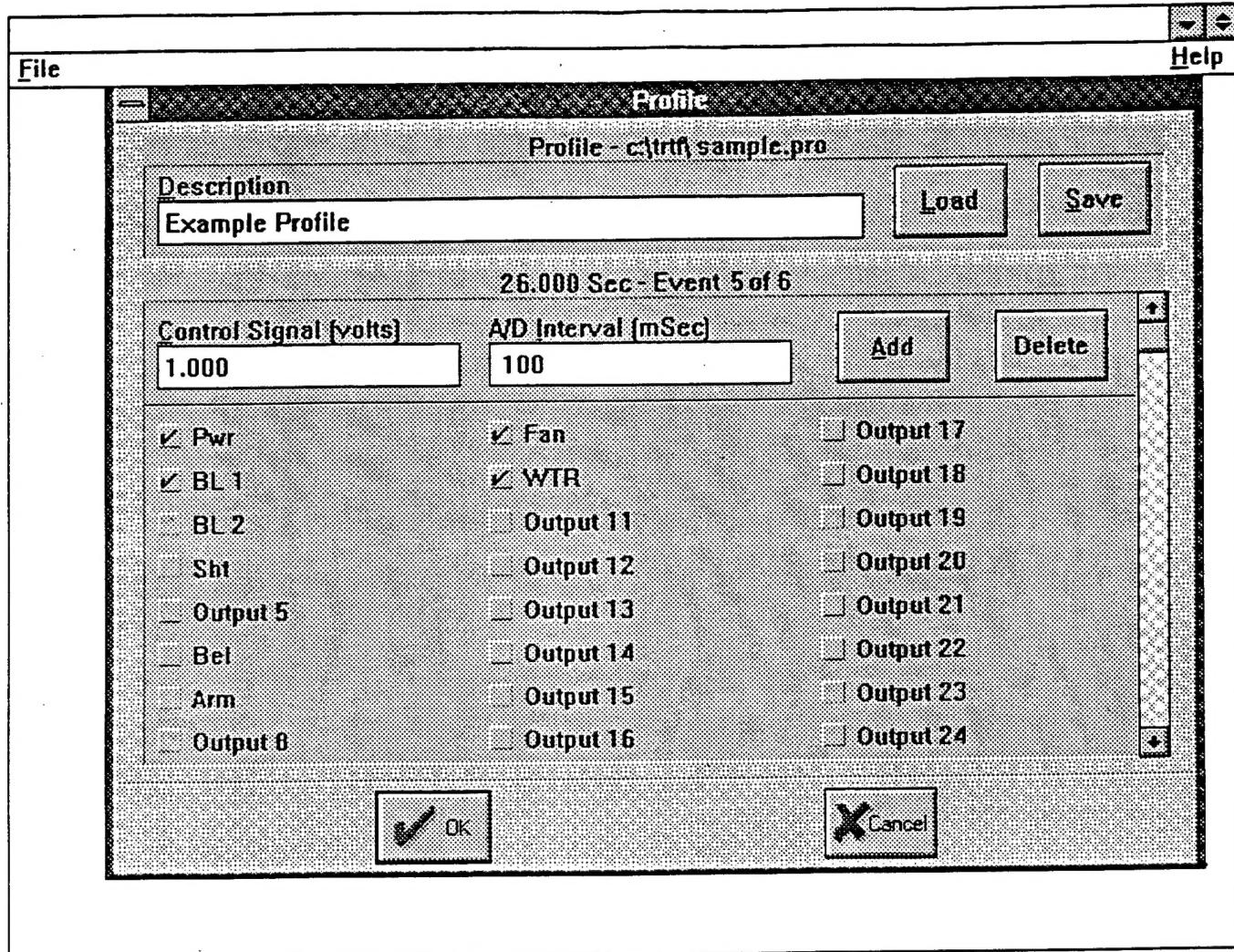
EVENT - 5
* The **Description** does not change.
5. Single click on **ADD**.

A. Enter the TIME (sec) of the fifth event.
     Single click O.K.
     * Note the time entered in the black shaded area.
     1. Click in area titled **Control Signal (Volts)**.
          Type in the 0 to 3.5 vdc control voltage to control the lamps.
          * The same voltage is generally used throughout the test.
     2. Click in area titled **A / D Interval (mSec)**.
          The length of the test has a direct bearing on this input.
          Enter 100 mSec.
          * Example, data collection starts at 20 sec. or event 3
          and finishes at the end of the test or 30 sec.
          This means data collection is 10 seconds long.
          Remember only 1000 data points per channel.
          10 sec. / 100ms or (interval) = 100 total data points.
     3. Use the mouse to check ON or OFF equipment used for this
          point in time for *EVENT - 5*.
          * In this example the **PWR , BL1, FAN ,** and the **WTR** are checked
          ON.
          * If the **ARM** is checked at this point be aware that the control voltage
          entered will be sent to the lamps.
          * Note the **ARM** is turned off 1 sec. after the shutter closes.
          This will terminate the 1 vdc control to the lamps.
     * * All options chosen at *EVENT - 5* will turn on at the time that was
          specified.
B. Goto *EVENT - 6* using **ADD**.

Profile

Profile - c:\trf\ sample.pro

Description

Example Profile   Load   Save

30.000 Sec - Event 6 of 6

Control Signal [volts]   **A/D Interval [mSec]**

0.000   0   Add   Delete

☐ Pwr   ☐ Fan   ☐ Output 17
☐ BL 1   ☐ WTR   ☐ Output 18
☐ BL 2   ☐ Output 11   ☐ Output 19
☐ Sht   ☐ Output 12   ☐ Output 20
☐ Output 5   ☐ Output 13   ☐ Output 21
☐ Bel   ☐ Output 14   ☐ Output 22
☐ Arm   ☐ Output 15   ☐ Output 23
☐ Output 8   ☐ Output 16   ☐ Output 24

✔ OK   ✗ Cancel
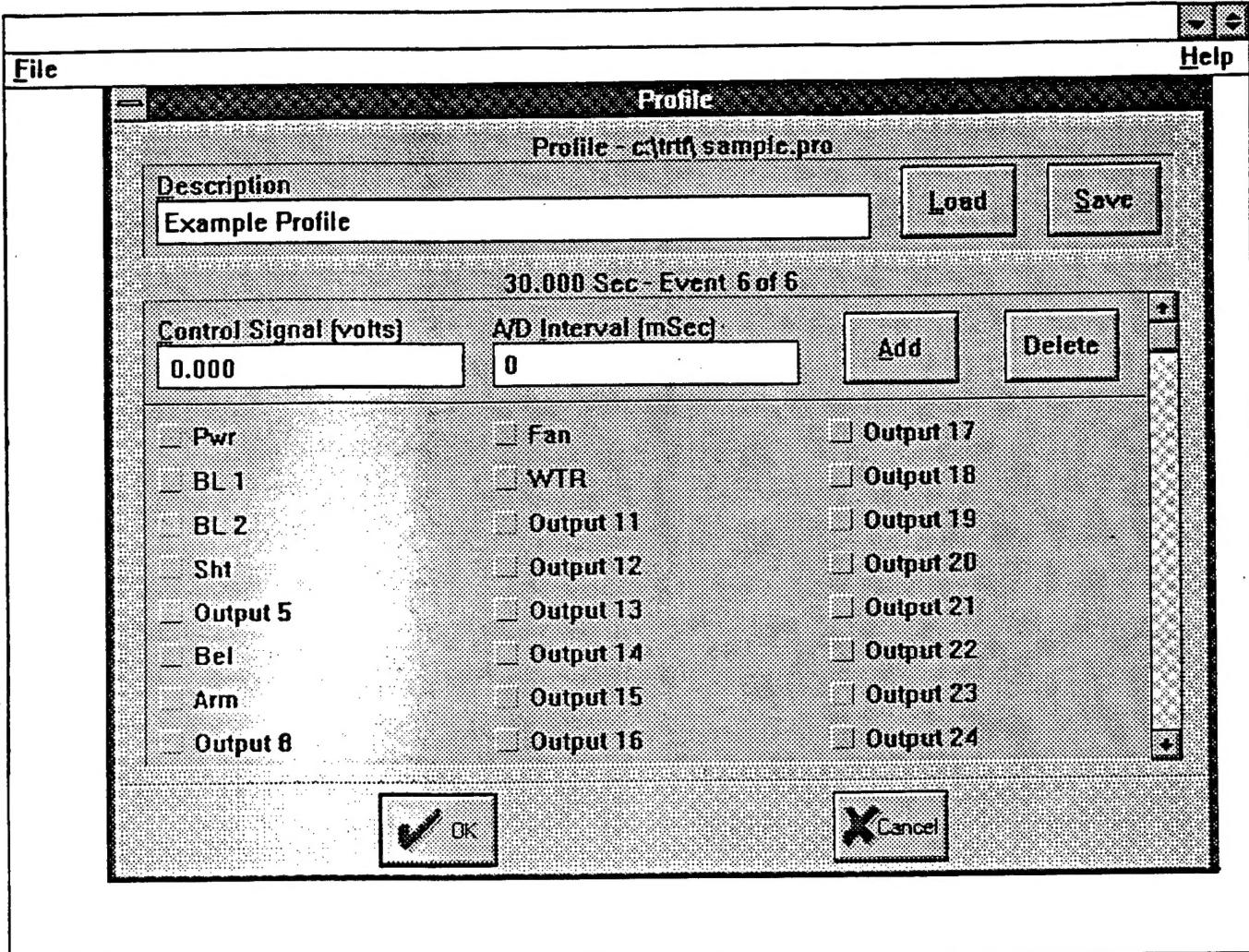
EVENT - 6
* The **Description** does not change.
6. Single click on **ADD**.
  A. Enter the TIME (sec) of the sixth event.
    Single click O.K.
    * Note the time entered in the black shaded area.
    1. Click in area titled **Control Signal (Volts)**.
      * Note the control voltage should be left at 0, because
       the *Shutter* is closed and the lamps are no longer **ARM** (armed).
    2. Click in area titled **A / D Interval (mSec)**.
      The **A / D mSec** is 0 because the test is finished at 30 seconds.
    3. Use the mouse to check ON or OFF equipment used for this
      point in time for *EVENT - 6*.
      * In this example all equipment is OFF.
      Generally the **FAN** is left ON to cool the lamps.
      * All options chosen at *EVENT - 6* will turn on at the time that was
      specified.
  B. Click on **SAVE**.
    1. Enter the file name of the new *Profile*.
      Example : ***example . pro***
    2. Select O.K.
  C. When **SAVE** has been performed use the up and down arrows to right
    to scroll through the events.
  D. Select **LOAD** an enter the *Profile* just *SAVED*.
    Select **O.K.** by the check mark if information is good.
  E. **DELETE** is only used to remove an *EVENT*.

A-7

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